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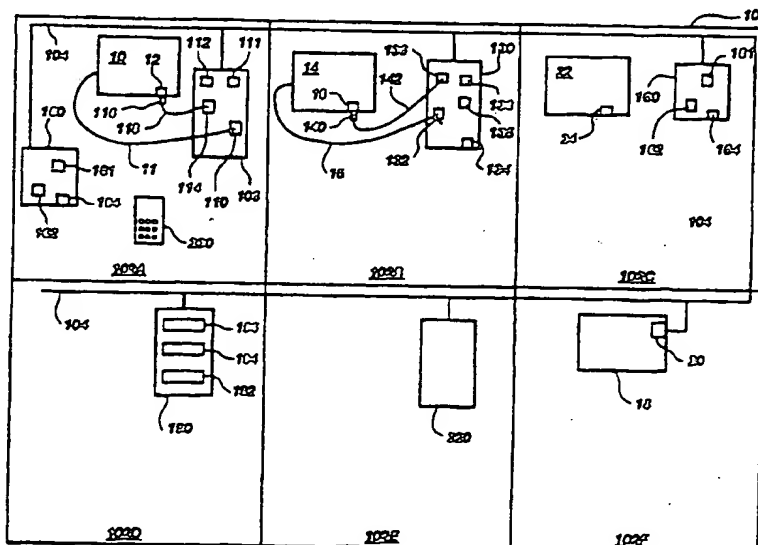
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(54) Title: AUTOMATED APPLIANCE CONTROL SYSTEM



## (57) Abstract

A system and method for retrofitting appliances for use with an appliance automation system and for augmenting/expanding an existing system wherein a universal transmitter (106) receives instructions from a central audio/visual controller or from any appliance automation controller (22). The universal transmitter (106) is configured for use with a single appliance (10) or can be used with any appliance having an infrared receiver. The present invention preferably communicates via the structure's AC wiring bus, in compliance with CEBus® standard. Control signals, issued by a hand-held infrared transmitter (230) or any appliance automation controller (22) connected to the signal-carrying bus, directs the universal transmitter (106) to signal the appliance being controlled. The invention also senses whether the appliance is in ON or OFF. A plurality of receivers can be placed in different rooms in the structure.

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## AUTOMATED APPLIANCE CONTROL SYSTEM

BACKGROUND5        1.    The Field of the Invention.

      This invention relates to apparatus used to communicate commands to electrical appliances from remote locations. More particularly, the present invention relates to appliance automation systems used to control household appliances.

102.    The Prior Art.

      The sophistication and number of features offered by consumer electrical equipment is rapidly increasing. As the number and complexity of electrical equipment increases, it has become more difficult to competently control all of the functions provided by such modern appliances. Consumers are also anticipating the widespread use of appliance automation systems, also commonly referred to as "home automation systems," which allow comprehensive control of a wide variety of appliances from one or more locations in a structure such as a residential structure.

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      Appliances which users are finding increasingly difficult to control include, but are not limited to, devices such as televisions, video cassette recorders, compact disc players, compact disc changers, laser disc players, audio cassette decks, audio receivers, video receivers, audio and video signal processing equipment, AM/FM tuners, digital audio cassette decks, cable television control boxes, motorized window coverings, motorized skylights, building heating and cooling systems, lighting control systems, computers, as well as other similar devices, all of which may hereinafter be referred to as "appliances."

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      As will be appreciated, there are a multitude of appliances already in use which are not compatible with any appliance automation system. Such presently available appliance automation systems include those systems which adhere to promulgated standards such as CEBus®, ECHELON®, SMART HOUSE, MEDIALINK® and D2B®

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5 appliance automation standards or any appliance  
automation standard now available or which may become  
available in the future. Government and industry action  
in the near future will likely mandate that newly  
10 manufactured appliances provide compatibility with one  
or more appliance automation standards.  
Disadvantageously, under the present state of the art,  
existing appliances will not be able to cooperate with  
the appliance automation systems which are now being  
15 proposed. Moreover, in view of the number of competing  
and incompatible appliance automation standards, some  
manufacturers may opt to incorporate features which are  
compatible only with an appliance automation standard  
which is different than those compatible appliances in  
the structure.

Moreover, if industry experts are correct, an  
explosion in the amount of information which is  
delivered to a residential or commercial location is  
about to occur. References to an "information super  
20 highway" are raising the expectation that every member  
of a modern industrialized society will soon have access  
to vast amounts of information for education, business,  
and entertainment. Moreover, the promise is being made  
that this information will be delivered to both  
25 commercial and residential locations in an easy and  
ready-to-use format.

Unfortunately, the promise of the information super  
highway may be wasted in many circumstances because of  
a lack of compatible equipment available for either the  
30 residential user or the commercial user. Each of the  
utility companies, including electric power service  
providers, telephone service providers, and cable  
television service providers, are all promising and  
vying to be the provider of the medium which will convey  
35 the information super highway to the multitude of  
residential and business customers. In order to  
accommodate the bandwidth needed to carry the data on

the information super highway, utility companies are proposing to devote enormous resources to installing fiber-optic media, or other wide bandwidth media, to each structure within its service area. Each of the utility companies are also hoping to provide the hardware which will be used within the structure to receive the information.

In view of the present state of the art, it would be an advance in the art to provide an improved appliance control system which is compatible with appliance automation systems which are already existing or which are installed in the future and which will allow the user to manage the information which is delivered to a structure.

BRIEF SUMMARY AND OBJECTS OF THE INVENTION

In view of the above-described state of the art, the present invention seeks to realize the following objects and advantages.

It is a primary object of the present invention to provide a system and method for retrofitting existing appliances for use with appliance automation systems.

It is also an object of the present invention to provide a system and method for interfacing with appliance automation systems allowing both compatible appliances and non-compatible appliances to be used therewith.

It is a further object of the present invention to provide a wireless control system for an appliance automation system.

It is also an object of the present invention to allow existing appliances without any automation capability to be addressed and controlled by an appliance automation system.

It is another object of the present invention to provide a system and method which replaces many appliance control devices with a single wireless appliance control device.

It is yet another object of the present invention to provide a system and method for allowing control over any appliance in a structure from any location in the structure.

5        These and other objects and advantages of the invention will become more fully apparent from the description and claims which follow, or may be learned by the practice of the invention.

10        The present invention provides a system and method for retrofitting appliances for use with an appliance automation system, also sometimes referred to as a home automation system. The present invention also augments and expands the function of an existing appliance automation system.

15        In accordance with one embodiment of the present invention, a single universal transmitter is provided which can receive instructions from a central audio/visual controller or from any instruction issuing appliance automation controller. The single universal  
20        transmitter is configured for use with a single appliance and can be used with any appliance having an infrared receiver to which it transmits infrared signals. It is preferred that the embodiments of the  
25        present invention communicate via the AC wiring bus in the structure in compliance with the CEBus® automation standard as will be explained below. Importantly, other communication protocols can also be used in accordance with the present invention.

30        The described embodiment of the single universal transmitter preferably includes means for receiving a first control signal. The first control signal may be issued by a hand-held infrared transmitter or any  
35        appliance automation controller which is connected to the signal-carrying bus. Also preferably included is a means for translating the first control signal into a second control signal and means for emitting the second control signal, which is recognized by the appliance as

a command, to an infrared receiver on the appliance, such as audio or video equipment. The means for emitting directs the infrared signal into the infrared receiver on the appliance. Also included is a means for selecting an address for the device so that the single universal transmitter will recognize just those instructions which are addressed to it.

One preferred embodiment of the single universal transmitter also includes means for sensing whether the appliance is in a power active state or a power-inactive state. Thus, the present invention ensures that the power on command is issued to the appliance only when the appliance is in a power-inactive state. Otherwise, in those appliances which do not recognize a discrete power on command and a discrete power off command, but merely toggle between on and off responding to the same command signal, the appliance may turn on when the power off state was desired and vice versa.

The means for sensing whether the appliance is in a power active state preferably includes means for providing AC current to the appliance, such as an AC receptacle, and means for sensing the current drawn by the appliance through the receptacle. A means for comparing the current drawn by the appliance with a predetermined threshold is provided. A means for manually varying the predetermined threshold is also provided. A means for perceptibly indicating to a user when the current drawn by the appliance exceeds the predetermined threshold is also provided so the user can set the predetermined threshold to match the current drawn when the appliance is in a power active state. Means for preventing the issuance of a power on command if the current drawn by the appliance exceeds the predetermined threshold (thus indicating that the appliance is already on) is also preferably included. The issuance of a power off command is similarly

inhibited if the appliance is already in its power-inactive state.

5 In accordance with the present invention, a plurality of receivers can be placed in different rooms in the structure and all the receivers are connected to the signal-carrying bus (preferably the AC wiring bus in the described embodiment) and thus convey instructions which they receive to the universal transmitter(s).

10 A hand-held transmitter is also included which allows a user to control a wide variety of appliances from any remote location in the structure. The hand-held transmitter preferably comprises an infrared emitter, a plurality of function keys which are programmable to carry out any one of a set of functions, 15 one set of preprogrammed functions for each of the appliances to be controlled, such as audio equipment, video equipment, or any other appliance which may be controlled with an appliance automation system. The hand-held transmitter also includes a display which 20 includes indicia indicating the current function of the function keys.

#### BRIEF DESCRIPTION OF THE DRAWINGS

25 In order to better appreciate how the advantages and objects of the invention are obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the 30 invention and are not therefore to be considered limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:



Figure 1 is a diagrammatic representation of a structure, such as a residential structure, with electrical appliances and embodiments of the present invention located therein.

5        Figures 2A-C are front, top, and side views, respectively, of a first embodiment of the present invention.

10        Figures 3A-B are front and back views, respectively, of a second embodiment of the present invention.

      Figures 4A-C are front, back, and top views, respectively, of a third embodiment of the present invention.

15        Figure 5 is a top view of a fourth embodiment of the present invention.

      Figures 5A-H are top views showing different configurations of the fourth embodiment of the present invention.

20        Figure 6 is a flow chart representing one preferred method of the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

      Reference will now be made to the drawings wherein like components will be provided with like reference designations.

25        Reference will first be made to Figure 1 which is a diagrammatic representation of a structure, generally represented at 100, such as a residential structure, in which are located a plurality of electrical appliances 10, 14, 22, and 18 and representative embodiments of the present invention 106, 130, 160, 190, and 230. Other electrical devices are also represented in Figure 1 as will be explained shortly.

30        Also represented in Figure 1 is a signal conducting bus 104. The signal conducting bus 104 represents one of many different mediums which can be used to allow information to be conveyed from one device in the structure 100 to all other pertinent devices in the

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structure 100. The signal-carrying bus 104 is presently preferred to be the AC power wiring bus of the structure. In particular, the CEBus® appliance automation standard is adapted to convey information between devices via the AC power bus of the structure 100. It will be appreciated that many other techniques can be used to provide information transfer between the devices of the present invention. For example, mediums such as coaxial cable, twisted pair cable, fiber optic cable, radio frequency transmission, as well as other mediums now known or developed in the future can also be used. The devices and techniques which are necessary to transfer information over an AC power bus, or any other of the mentioned mediums, are known in the industry and those skilled in the art can readily adapt such technologies for implementation in embodiments of the present invention using the information set forth herein. Further information regarding the CEBus® standard can be obtained from the Electronics Industry Association of Washington, D.C.

It is also to be understood that the term "structure," as used herein, includes any man-made edifice including those which are not contiguous, such as a number of individual buildings which are separated by large distances. The present invention, however, provides the greatest benefits when applied in a residential dwelling structure comprising a plurality of rooms, also referred to herein as enclosures, and represented in Figure 1 at 102A-F. Significantly, not only has the industry heretofore not solved the problems which the present invention solves but the industry has not even recognized such problems.

Represented in Figure 1 in enclosure 102A is an appliance 10, for example a television. The appliance 10 includes an infrared receiver 12. The infrared receiver 12 is generally intended to receive coded infrared transmissions from a hand-held transmitter (not

illustrated) sold with the appliance 10, often referred to as a "remote control," which sends a modulated/coded infrared signal to the appliance 10 which, when decoded, provides operating commands. As used herein, the term "remote" is intended to refer to any location which is outside of the housing or cabinet of an appliance or other device.

It will be appreciated that the preferred embodiments of the present invention described herein can be utilized to instruct appliances which direct the conveyance of information both within a structure as well as those appliances which direct information into and out of a structure. Thus, the present invention has application with appliances, devices, and equipment described in U.S. Patent Application Serial No. 08/301,910 filed on September 7, 1994 entitled Electronic Information Interface which is now incorporated herein by reference in its entirety.

As indicated earlier, many appliances are or will be manufactured to be compatible with one or more appliance automation standards, including the CEBus® standard. Other exemplary standards which can benefit from the present invention include those known in the industry as ECHELON®, D2B®, SMART HOUSE and MEDIALINK®. The appliance 10 in Figure 1 is not compliant with the appropriate appliance automation standard and thus the system of the present invention is implemented to provide such compatibility in a retrofit manner and to provide other advantages as well. If appliance 10 were compliant with one or more appliance automation standards, the appliance 10 would preferably recognize and carry out instructions addressed to it via the signal-carrying bus 104.

Represented in Figure 1, and depicted within enclosure 102A, is a signal universal transmitter 106. The single universal transmitter 106 provides the great advantage of making the appliance 10 compatible with an

appliance automation standard, for example the CEBus® standard. Most advantageously, the single universal transmitter 106, as well as other embodiments of the present invention, can be easily installed and operated by the user. The single universal transmitter 106 can be configured to be used with virtually any single appliance which includes an infrared receiver, such as infrared receiver 12, which receives coded infrared signals conveying operating instructions.

The single universal transmitter 106 is connected to the signal-carrying bus 104 from which it receives commands in accordance with a communication standard and, in the example discussed herein, electrical power for its operation. The single universal transmitter 106 includes an AC power receptacle 110 into which an AC power cord 11 of the appliance 10 is inserted. As will be explained shortly, the single universal transmitter 106 senses the AC current drawn by the appliance 10.

Also included in the single universal transmitter 106 are address selection switches 112 which allow a user to set the address at which the single universal transmitter 106 will recognize appliance automation commands present on the signal-carrying bus 104. As will be explained shortly, the single universal transmitter 106 translates the commands received on the signal-carrying bus 104, such as an appliance "power on command," into a modulated infrared signal compatible with the infrared receiver 12 and the appliance 10. The modulated infrared signal is generated by an infrared modulator 114 included in the single universal transmitter 106. The modulated infrared signal is conveyed to the appliance 10 via a cable 118 and an infrared emitter 116 which is preferably located near the appliance's infrared receiver 12. Also included is a processor and memory 111 which includes the interfaces necessary to carry out communications on the signal-

carrying bus 104 and other necessary functions as will be appreciated by those skilled in the art.

Reference will now be made to Figures 2A-C to provide a more detailed description of the structure and operation of the preferred single universal transmitter 106. As indicated earlier, the single universal transmitter 106 receives instructions via the signal-carrying bus 104 which in the present example is the AC wiring bus upon which instructions are conveyed in accordance with the CEBus® appliance automation standard. The single universal transmitter 106 is installed near the appliance, for example appliance 10 in Figure 1, which is to be controlled. The single universal transmitter 106 is preferably received into a conventional NEMA compatible receptacle (not shown in the figures) which are found in both residential and commercial structures connected to the AC wiring bus. Extending from the back side of the single universal transmitter 106 are hot, common, and ground prongs all represented at 126 in Figure 2C. The single universal transmitter 106 includes a power supply which derives the necessary DC voltage needed to power the components of the single universal transmitter 106. It will be appreciated that techniques other than the CEBus® standard can be used to convey instructions to the single universal transmitter 106 and other techniques can also be used to power the single universal transmitter 106.

As represented in Figure 2A, a NEMA compatible receptacle 110 is included on the single universal transmitter 106. As indicated in Figure 1, the AC power cord of the appliance 10 is inserted into the receptacle 110 and the appliance derives its AC power therefrom. The single universal transmitter 106 includes a current monitor to sense the current being drawn by the appliance 10. The current monitor is included to determine the "power status" of the appliance 10, that

is whether the appliance is turned on or turned off. For example, if the appliance 10 is a video cassette recorder (VCR) the appliance 10 will likely draw a small amount of current even when the appliance 10 is in a "power off" or "power inactive" state in order to operate a clock which is displayed on the appliance 10. Other appliances may similarly draw current even though they are in a power off or power-inactive state.

Since it is essential for the single universal transmitter 106 to unambiguously command the appliance 10 to go to a "power on" state or to a "power off" state, the single universal transmitter 106 must be able to determine which of the two states the appliance 10 is in when the command is to be issued. Importantly, the current monitor allows the single universal transmitter 106 to be used universally, even with appliances which do not utilize a discrete power on signal and a discrete power off signal which is recognized by the infrared receiver 12. Such appliances generally utilize the same infrared signal command which instructs the appliance to toggle between a power on state and a power off state.

In order to effectively determine whether the appliance 10 is in a power on state or in a power off state, the sensitivity of the current monitor can be adjusted using sensitivity adjustment 125. In use, the appliance 10 is turned on and off while the sensitivity adjustment is varied and a power status LED 122 indicates the sensed state of the appliance 10. The power status LED 122 tracks the power state of the appliance 10 and the sensitivity adjustment is varied until the power status LED 122 and the actual power state of the appliance agree with each other. Once adjusted, the single universal transmitter 106 will advantageously "know" the power status of the appliance 10 so that in those appliances without discrete power on and power off commands, a command will never be issued which will cause the appliance to toggle to the power

off mode when it was desired to power on the appliance, and vice versa. If the single universal transmitter 106 senses that the appliance 10 is already on when the single universal transmitter 106 receives a "turn on command" for that appliance the issuance of the IR power command to the appliance 10 is inhibited. Further explanation of this feature of the present invention will be described in connection with Figure 6.

The described arrangement provides a great advance over those previously available control systems for controlling audio/video systems. Such previously available control systems must have the output of the current sensing devices hard wired back to a central control system that, by way of a software program, tracks the power state of all the appliances being controlled. If for some reason, and as regularly occurs with such systems, the power status of an appliance is lost the user ends up with an audio/video system which seems to have a mind of its own; for example going to the power on state when the power off state is desired. The described feature of the present invention overcomes this drawback and results in a device which actually senses the power state of the one appliance plugged into the receptacle 110.

As indicated earlier, the single universal transmitter 106 receives instructions via the signal-carrying bus 104 (Figure 1) and is considered part of an appliance automation system. It is presently preferred that the processor and memory 111 include a CEBus® appliance automation system controller such as that available from Intellon Corporation (Ocala, Florida) and referred to as a CENode board as known in the art. The use of the described CEBus® controller allows the present invention to integrate into any CEBus® network and it is preferred that communications over the signal-carrying bus 104 be made using the highly reliable spread spectrum communications techniques which are

5 available from those providing CEBus® devices. It will be appreciated, however, that other standards can also be used in accordance with the present invention, both those described herein and those which may otherwise be available now or in the future.

10 The single universal transmitter 106 is provided with three address selection switches 112 which are represented in Figure 2B. The address selection switches 112 allow a user to easily set the address of the single universal transmitter 106. It will be appreciated that the three address selection wheels allow sufficient digits to allow a large number of devices to be each have their own unique address among devices controlled by the appliance automation system.

15 It will be appreciated that using the information herein, those skilled in the art can readily implement the described address selection switches 112 or a number of different address selection techniques.

20 Figure 2A provides a further representation of the infrared emitter 116 which transmits the modulated infrared signals to the infrared receiver 12 on the appliance 10 (Figure 1) to cause the appliance 10 to carry out the desired operations. The infrared emitter 116 is wired to the single universal transmitter 106 via a cable 118.

25 The infrared emitter 116 is preferably secured over the infrared receiver 12 on the appliance 10 to block the reception of other infrared signals. For example, the infrared emitter 116 is preferably secured over the infrared receiver 12 by double-sided adhesive tape so that the infrared signals emitted thereby are directed into the infrared receiver 12. The infrared emitter 116 can also be installed inside the appliance, if desired for aesthetic or other reasons, with the necessary installation procedures.

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35 It will be appreciated that the infrared emitter 116 and cable 118 provide very reliable conveyance of infrared signals to the infrared receiver 12 on the



appliance 10 and is usable with a large number audio/video devices since most such devices of recent manufacture include an infrared receiver 12. Moreover, it is within the scope of the present invention to provide other devices to communicate between the single universal transmitter 106 and the appliance 10 in accordance with whatever technology may be developed or adopted in the future.

As is known in the industry, many manufacturers configure infrared receivers, such as indicated at 12 in Figure 1, to recognize and respond to only a unique set of infrared codes. Thus, a manufacturer of an appliance is supposedly able to prevent remote control devices from another manufacturer from working with the appliance. In reality, the necessary infrared codes needed to work with any particular appliance can be readily discovered. The single universal transmitter 106 includes a library of infrared codes for several hundred appliances. The code library can preferably be updated or changed in any manner known in the art, for example by replacing a read-only memory, via a serial port connection (not represented in the figures), or via the appliance automation network.

As shown in Figure 2A, the single universal transmitter 106 includes a keypad 128. With the keypad 128, a user can enter a number on the keypad 128 to select which set of infrared codes from the library of infrared codes will apply. Thus, a user is supplied with a list of appliances organized by manufacturer and/or model and is instructed to enter the proper number on the keypad 128. Once the number is entered on the keypad 128, the single universal transmitter 106 will look up the infrared code which properly translates the instructions received from the appliance automation network and conveys the proper infrared code to the infrared emitter 116. When the number is being entered on the keypad 128 an LED 120 indicates whether the

proper infrared code has been found by the color of the LED 120, different colors representing acceptance of the number, rejection of the number, or general trouble. The LED 120 will also blink when an infrared code is being sent to the infrared emitter 116 to confirm operation.

From the forgoing description, it will be understood that the installation and operation of the single universal transmitter 106 can be readily accomplished. The installation of the single universal transmitter 106 consisting of few major steps, including, plugging the single universal transmitter 106 into the receptacle (not represented) connecting to the AC wiring bus 104, plugging the controlled appliance into the receptacle 110 on the single universal transmitter 106, and setting the current monitor threshold by varying the sensitivity adjustment while cycling the appliance on and off and assuring that the power status LED 122 follows the status of the appliance. After these steps, the user then need only look up from a provided list the manufacturer and model of the appliance and inputting the number on the keypad 128 which corresponds to the set of infrared codes to which the appliance will respond. Finally, the infrared emitter 116 is preferably secured over the appliance's infrared receiver (12 in Figure 1).

As indicated earlier, the single universal transmitter 106 is responsive to instructions conveyed via the signal-carrying bus (104 in Figure 1) which acts as communications network for the appliance automation system. As will be appreciated by those skilled in the art, the pertinent instructions can be issued, and the operation of all devices responsive to the appliance automation system coordinated, by an appliance automation network controller 220 depicted at Figure 1 in enclosure 102E. The appliance automation network controller can be any number of devices available in the

industry, for example dedicated devices can be used or a general purpose PC compatible computer with the appropriate interfaces can also be used.

5 Referring again to Figure 1, the present invention also allows the user to maintain the convenience of operating the appliance 10 using a hand-held transmitter represented at 230. While the hand-held transmitter 230 is depicted in enclosure 102A, it will be appreciated that the hand-held transmitter can move from enclosure 10 to enclosure (i.e., room to room) as will be explained shortly. Moreover, the present invention allows the user to control not only the appliance 10 using the hand-held transmitter 230 but also any other device, for example computer and communications equipment, 15 responsive to the instructions issued on the signal-carrying bus 104. Thus, in accordance with the present invention, a user can have the benefit of potentially controlling numerous appliances from the hand-held transmitter 230 regardless of where the appliance is 20 located in the structure.

In order to accommodate the hand-held transmitter 230 shown in Figure 1 a receiver 160 is included. The receiver is connected to the signal-carrying bus 104 which in the present example is the AC wiring bus from 25 which the receiver receives instructions and power necessary for operation. While the receiver 160 is depicted in enclosure 102A, it will be appreciated that a receiver 160 can be placed in any of the enclosures 102A-F or, most advantageously, that a receiver can be 30 placed in each enclosure 102A-F in order to allow operation of the hand-held transmitter 230 in any enclosure. In the example represented in Figure 1, a receiver 160 is also depicted in enclosure 102C and a receiver/universal transmitter 130 is depicted in 35 enclosure 102B which allows the hand-held transmitter 230 to operate effectively in any of enclosures 102A-C.

The receiver 160 includes an infrared receiver 164, address selection switches 162, and a processor 161 as may be necessary to communicate with other devices on the appliance automation network and to carry out other required functions. Reference will now also be made to Figures 3A and 3B which are front and back views of a preferred embodiment of the receiver 160. The receiver 160 includes a power switch 170, a power indicator LED 166 which illuminates when the receiver 160 is in a power on state, and an infrared signal reception LED 168 which illuminates when an infrared signal from the handheld transmitter 230 is received.

Also represented in Figure 3A is another view of the receiver 160. The receiver 160 is preferably configured to receive CEBus® CAL codes as known in the industry and to retransmit such codes on the CEBus® network using a medium such as the signal-carrying bus 104. Other communication protocols can also be used, as will be explained shortly. The processor 161 (Figure 1) preferably comprises a CENode controller board which utilizes spread spectrum communications technology as is available from Intellon.

Referring next to Figure 3B, two address selection switches 162 are provided. The address selection switches 162 include only two switches, for example two sixteen position switches, which are used to identify the enclosure or room in which the receiver 160 is located. The location of the receiver 160 is transmitted on the signal-carrying bus 104 so that other devices can be made aware of the location of the receiver 160.

The capability of selecting an address for the receiver 160 allows the receiver 160 to be addressed directly to a group of infrared transmission devices for simple point to point control in the case of one central audio/visual source appliance location and multiple reception points as is the case where the control

instructions for a source audio/visual appliance being controlled are modulated onto an unused cable television channel by the use of modulator device, such as those available in the industry from Pico Products, Inc. (New York, New York) or the equivalent. Also illustrated in Figure 3B is a power cord 172 through which the receiver 160 receives electrical power and preferably conveys information onto the signal-carrying bus 104.

Reference will next be made to Figure 5 which is a more detailed top view of the hand-held transmitter 230. The hand-held transmitter 230 includes a battery (not represented) which powers the hand-held transmitter 230. The hand-held transmitter 230 includes an infrared emitter 232 as can be selected from those available in the art. An LCD date/time display 234 is also provided. While it is preferred to utilize infrared radiation to communicate between the hand-held transmitter 230 and the receiver 160, it will be appreciated that other mediums and technologies can be used within the scope of the present invention.

Also represented in Figure 5 are a number of information providing displays and input interfaces as will now be explained. The preferred hand-held transmitter 230 described herein includes eight device selection switches 246: TV1 (Television 1); TV2 (Television 2); VCR (Video cassette recorder); CBL (Cable television box); LD (Laser disc player); CD (Compact disc player); AUD (Audio amplifier); and AUX (Auxiliary device). The hand-held transmitter 230 includes a processor and associated memory which are programmed to select an appropriate set of infrared codes in accordance with which of the eight device selection switches have been chosen. A programming key 242 is provided to allow the hand-held transmitter 230 to receive programming from an external source through a plug (not illustrated) and to set the LCD date/time

display 234. A light key 244, when activated, causes the various displays to be illuminated.

5 The hand-held transmitter 230 also includes a dedicated power key 236 which when depressed causes the infrared emitter 232 to emit a modulated infrared signal which, when perceived by the receiver 160 (Figures 1 and 3A-B) and dispatched on the signal-carrying bus 104, is interpreted as a "power off" or "power on" instruction to the appropriate device. The hand-held transmitter 10 230 also includes a set of dedicated numeric keys 238. Also included in the hand-held transmitter 230 is an LCD touch screen 240. The LCD touch screen includes a transparent touch screen, such as one provided by an ITO coating, which is sensitive to the touch of a user and forms a plurality of keys. Under the transparent touch 15 screen is an LCD display which changes in accordance with which one of the device selection switches 246 has been chosen. The LCD display exhibits appropriate alpha/numeric characters or icons to indicate to the user the function which has been assigned to the particular key of the touch screen. The preferred touch 20 screen and the LCD display can be selected from those available in the industry.

25 Figures 5A-H illustrate exemplary configurations of the touch screen LCD 240. Each of Figures 5A-H show a different configuration for the touch screen LCD 240 showing the appropriate functions assigned to each key in accordance with the device which has been selected via device selection keys (246 in Figure 5). It will be 30 appreciated that the functions represented in Figures 5A-H are merely exemplary and different or additional functions may also be utilized. Provided below in Table A is a list of the devices and the figure which illustrates corresponding touch screen LCD 240.

TABLE A	
Device	Figure
TV1	5A
TV2	5B
VCR	5C
CBL	5D
LD	5E
CD	5F
AUD	5G
AUX	5H

It will be appreciated that many variations on those displays represented in Figures 5A-H can be implemented within the scope of the present invention. Moreover, hand-held transmitters, as well as other similarly functioning devices, can be implemented within the scope of the present invention which includes only dedicated function keys. It will be further appreciated that the hand-held transmitter 230 can be programmed to control many more devices than represented in Figures 5A-H. Furthermore, the hand-held transmitter 230 can be configured to allow downloading of infrared codes into its internal memory (via infrared or electrical link) to allow the infrared codes for a large number of devices to be stored. Still further, it is within the scope of the present invention to allow the user to program the hand-held transmitter 230 so that text or icons can be displayed for particular devices.

It is preferred that the hand-held transmitter 230, the single universal transmitter 106, and the receiver 160 all communicate using the CEBus® CAL language as specified in the EIA IS60 Standard, which is now incorporated herein by reference in its entirety including all promulgated drafts and revisions thereof as of the date this specification is filed. It will be understood that other standards and techniques can also be used for communications between the devices described herein.

For example, the hand-held transmitter 230 can utilize a set of numeric codes which will be received by the receiver 160 and placed on the signal-carrying bus 104 where they will be intercepted by an audio/visual subsystem controller represented at 190 in Figure 1. The audio/visual subsystem controller 190 preferably includes a keyboard 192, a display 194, and a processor with the necessary interface circuitry for whatever appliance automation standard is being used and to communicate with the signal-carrying bus 104. The audio/visual subsystem controller 190 can be used alone to receive, translate, and send information to other devices along the signal-carrying bus 104 if no appliance automation network controller 220 (depicted at Figure 1 in enclosure 102E) is present. Alternatively, the audio/visual subsystem controller 190 can be used in combination with the appliance automation network controller 220. It will be appreciated that the designation "audio/visual" is used since audio/visual appliances are most preferred for use with the present invention but other types of appliances can also benefit from the present invention. Thus, when the CEBus® CAL language is used, any CEBus® based whole house appliance controller can be used to send instructions to the devices of the present invention. When the described numeric codes, or their equivalent are used, the audio/video subsystem controller 190 can be used alone.



An exemplary numeric code which can be used (rather than the CEBus® CAL language) can utilize a plurality of code pages with the numeric codes which will be transmitted as infrared codes for each selected device being found on an individual code page. For example, the numeric infrared codes for the TV1 code page might start at 2 for "power on," 3 for "power off," and so forth, until the last function, for example, 42 for "PIP move" was reached. The code page for TV2 would begin at 43 for "power on," 44 "for power off," and so on. In this manner an extremely simple set of infrared codes are generated for those applications where the expense of strict compliance with an appliance automation language is not necessary. Such a numeric code also prevents interference with other devices which communicate using infrared transmissions. By using numeric codes as described, each code page stored in the hand-held transmitter 230 has different numbers assigned to the keys 240 in Figure 5 and eliminates the requirement of actual appliance/device addressing as would be required if the CEBus® CAL language were used. Using the described numeric codes, the appliance for which the code is intended is inherent in the code thus any appliance or device on the signal-carrying bus 104 will know which codes are intended for it.

For example, codes for TV1 can start at 2 and end at 19 so if the single universal transmitter 106 associated with TV1 "hears" code 94 the single universal transmitter 106 won't react since the code falls outside it's programmed range. However, if code 7 were conveyed on the signal-carrying bus 104 then the single universal transmitter 106 would send whatever infrared code that corresponds to that code.

Using the described numeric codes, the hand-held transmitter 230 also includes one or more code pages dedicated to "system functions" or functions that invoke macros which have been programmed into the audio/video

subsystem controller 190. These code pages would have keys labeled "start show," "intermission," "end show," "VCR show," "laser disk show," and so forth as desired. The codes sent from these code pages would be outside the codes described above and would be received by the audio/visual subsystem controller which would then send out the discrete commands to the individual appliances as directed by macros programmed by the user to carry out the desired functions.

Exemplary numeric codes for the devices indicated in Figure 5, as well as for additional devices, are set forth in Table B provided below.

=====

**TABLE B**

Command #	Device	Command Name	Command #	Device	Command Name
	TV1			TV2	
2	TV	On	20	TV	On
3	TV	Volume Up	21	TV	Volume Up
4	TV	Volume Stop	22	TV	Volume Stop
5	TV	Set Volume (%)	23	TV	Set Volume (%)
6	TV	Volume Down	24	TV	Volume Down
7	TV	Channel Up	25	TV	Channel Up
8	TV	Channel Down	26	TV	Channel Down
9	TV	Select Input (#)	27	TV	Select Input (#)
		(ant, Video, Cable1, C			(ant, Video, Cable1, C
10	TV	Select Video Mode (#)	28	TV	Select Video Mode (#)
		(NTSC, SNTSC, HDT)			(NTSC, SNTSC, HDT)
11	TV	Select Audio Mode (#)	29	TV	Select Audio Mode (#)
		(stereo, mono, su)			(stereo, mono, su)
12	TV	Set Channel (#)	30	TV	Set Channel (#)
13	TV	Select PIP Channel (#)	31	TV	Select PIP Channel (#)
14	TV	Deselect PIP	32	TV	Deselect PIP
15	TV	Mute	33	TV	Mute
16	TV	Unmute	34	TV	Unmute
17	TV	Off	35	TV	Off
18	TV	Set D (D) T (T)	36	TV	Set D (D) T (T)
	CAB1			VCR1	
182	CAB	On	262	VCR	On
183	CAB	Select Input (#)	263	VCR	Fast Forward
		(cable1, cable2, etc)	264	VCR	Rewind
184	CAB	Set Channel (#)	265	VCR	Select Input (#)
185	CAB	Channel Up			(ant, video, cable1)

25

186 CAB Channel Down  
 187 CAB Off  
 188 CAB Set D (D) T (T)

5

## TUN1

422 TUN On  
 423 TUN Off  
 424 TUN Set Channel (freq)  
 425 TUN Select Preset (#)  
 426 TUN Seek  
 427 TUN Scan  
 428 TUN Step Up Preset  
 TUN1  
 429 TUN Step Down Preset  
 430 TUN Select AM  
 431 TUN Select FM  
 432 TUN Set D (D) T (T)

10

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20

## AMP1

1232 AMP On  
 1233 AMP Off  
 1234 AMP Zone (#) Volume Up  
 1235 AMP Zone (#) Volume Stop  
 1236 AMP Zone (#) Set Volume (%)  
 1237 AMP Zone (#) Volume Down  
 1238 AMP Zone (#) Select  
 Input (#)  
 1239 AMP Zone (#) Select  
 Loudness  
 1240 AMP Zone (#) Deselect  
 Loudness  
 1241 AMP Zone (#) Increase  
 Treble  
 1242 AMP Zone (#) Decrease  
 Treble  
 1243 AMP Zone (#) Increase Bass  
 1244 AMP Zone (#) Decrease Bass  
 1245 AMP Zone (#) Mute  
 1246 AMP Zone (#) Balance Left  
 1247 AMP Zone (#) Balance Right  
 1248 AMP Zone (#) Balance Front

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266 VCR Set Channel (#)  
 267 VCR Channel Up  
 268 VCR Channel Down  
 269 VCR Select VCR tuner  
 270 VCR Select other tuner  
 271 VCR Play  
 272 VCR Stop  
 273 VCR Start Record Channel  
 (#) at (time)  
 274 VCR Stop Record at (time)  
 275 VCR Off  
 276 VCR Set D (D) T (T)

## SSP1

1012 SSP On  
 1013 SSP Off  
 1014 Volume Up  
 1015 SSP Volume Stop  
 1016 SSP Set Volume (%)  
 1017 SSP Volume Down  
 1018 SSP Select Mode (#)  
 1019 SSP Select Input (#)  
 1020 SSP Select Loudness  
 1021 SSP Deselect Loudness  
 1022 SSP Increase Treble  
 1023 SSP Decrease Treble  
 1024 SSP Increase Bass  
 1025 SSP Decrease Bass  
 1026 SSP Balance Left  
 1027 SSP Balance Right  
 1028 SSP Balance Front  
 1029 SSP Balance Rear  
 1030 SSP Mute  
 1031 SSP Unmute  
 1032 SSP Set D (D) T (T)

## VDP1

1442 VDP On  
 1443 VDP Off  
 1444 VDP Scan Forward

26

	1249	AMP Zone (#) Balance Rear	1445	VDP Scan Backwards
	1250	AMP Zone (#) Unmute	1446	VDP Select Input (#)
	1251	AMP Zone (#) Set D (D) T (T)		(ant, video, cable1,)
5		AUX1	1447	VDP Select Disk Side (#)
	2402	Function 1	1448	VDP Set Channel (#)
10	2403	Function 2	1449	VDP Play
	2404	Function 3	1450	VDP Stop
	2405	Function 4	1451	VDP Pause
	2406	Function 5	1452	VDP Unpause
	2407	Function 6	1453	VDP Open
15	2408	Function 7	1454	VDP Close
	2409	Function 8	1455	VDP Select VDP Tuner
	2410	Function 9	1456	VDP Select other Tuner
	2411	Function 10	1457	VDP Set D (D) T (T)
		CDP1		
20	542	CDP On		CASS 1
	543	CDP Off	1612	CASS On
	544	CDP Select Disk (#)	1613	CASS Off
	545	CDP Select Track (#)	1614	CASS Fast Forward
	546	CDP Select Random	1615	CASS Rewind
25	547	CDP Seek Forward	1616	CASS Play
	548	CDP Seek Backward	1617	CASS Pause
	549	CDP Scan	1618	CASS Unpause
	550	CDP Open	1619	CASS Stop
	551	CDP Close	1620	CASS Select NR Mode (#)
30	552	CDP Play		(Dolby A,B,C, etc)
	553	CDP Pause	1621	CASS Select Line Input
	554	CDP Unpause	1622	CASS Deselect Line Input
	555	CDP Stop	1623	CASS Select Mic Input
	556	CDP Set D (D) T (T)	1624	CASS Deselect Mic Input
35		RVCR1	1625	CASS Start Record
	702	RVCR On	1626	CASS Stop Record
40	703	RVCR Off	1627	CASS Deck A Fast Forward
	704	RVCR Volume Up	1628	CASS Deck A Rewind
	705	RVCR Volume Stop	1629	CASS Deck A Play
	706	RVCR Set Volume (t)	1630	CASS Deck A Pause
	707	RVCR Volume Down	1631	CASS Deck A Unpause
	708	RVCR Set Channel (freq)	1632	CASS Deck A Stop
45	709	RVCR Select Preset (#)	1633	CASS Deck A Select Line
				Input
			1634	CASS Deck A Deselect Line
			1635	CASS Deck A Select Mic
				Input

27

	710	RVCR Select Input (#)	1636	CASS Deck A Deselect Mic Input
	711	RVCR Select Mode (#)		
5	712	RVCR Seek	1637	CASS Deck A Start Record
	713	RVCR Scan	1638	CASS Deck A Stop Record
	714	RVCR Step Up Preset	1639	CASS Deck B Fast Forward
	715	RVCR Step Down Preset	1640	CASS Deck B Rewind
	716	RVCR Select AM	1641	CASS Deck B Play
10	717	RVCR Select FM	1642	CASS Deck B Pause
	718	RVCR Select Mode (#)	1643	CASS Deck B Unpause
	719	RVCR Select Loudness	1644	CASS Deck B Stop
	720	RVCR Deselect Loudness	1645	CASS Deck B Select Line Input
	721	RVCR Increase Treble	1646	CASS Deck B Deselect Line Input
15	722	RVCR Decrease Treble	1647	CASS Deck B Select Mic Input
	723	RVCR Increase Bass	1648	CASS Deck B Deselect Mic Input
	724	RVCR Decrease Bass	1649	CASS Deck B Start Record
	725	RVCR Mute	1650	CASS Deck B Stop Record
	726	RVCR Balance Left	1651	CASS Select Metal Tape
20	727	RVCR Balance Right	1652	CASS Deselect Metal Tape
	728	RVCR Balance Front	1653	CASS Select Normal Tape CASS1
	729	RVCR Balance Rear	1654	CASS Deselect Normal Tape
	730	RVCR Unmute	1655	CASS Select CRO2 Tape
25	731	RVCR Set D (D) T (T)	1656	CASS Deselect CRO2 Tape
			1657	CASS Set D (D) T (T)

Reference will next be made again to Figure 1 wherein is represented a combined universal transmitter/receiver 130 depicted within enclosure 102B. The combined universal transmitter/receiver 130 combines the functions of the single universal transmitter 106 and the receiver 160. Thus, the combined universal transmitter/receiver 130 further provides the great advantage of making an appliance 14 compatible with an appliance automation standard, for example the CEBus® standard. Furthermore, as with other embodiments described herein, the combined universal transmitter/receiver 130 can be easily installed and

operated by the user. The combined universal transmitter/receiver 130 can be configured for use with virtually any appliance which includes an infrared receiver, such as infrared receiver 16, which receives coded infrared transmissions conveying operating instructions.

The combined universal transmitter/receiver 130 is connected to the signal-carrying bus 104 from which it receives instructions in accordance with an appliance automation standard and, in the examples discussed herein, electrical power for its operation. An infrared emitter 140 is also connected to an infrared modulator 136 via a cable.

Reference will now be made to Figures 1 and Figures 4A-C for a more detailed explanation of the combined universal transmitter/receiver 130. The combined universal transmitter/receiver 130 includes an AC power receptacle 132 (Figure 4B) into which an AC power cord 15 of the appliance 14 is inserted. As was explained in connection with the single universal transmitter 106, the combined universal transmitter/receiver 130 senses the AC current drawn by the appliance 10 in order to determine the power status of the appliance 14.

Still referring to Figure 1, the combined universal transmitter/receiver 130 includes a current monitor to sense the current being drawn by the appliance 104. The current monitor of the combined universal transmitter/receiver 130 functions similarly to the current monitoring feature of the single universal transmitter 106. Since it is essential for the combined universal transmitter/receiver 130 to unambiguously command the appliance 14 to go to a "power on" mode or to a "power off" mode, the combined universal transmitter/receiver 130 must be able to determine which of the two states the appliance 14 is in when the command is to be issued. Importantly, the current monitor allows the combined universal

transmitter/receiver 130 to be used universally, even with appliances which do not utilize a discrete power on signal and a discrete power off signal which is recognized by the infrared receiver 16.

5 In order to effectively determine whether the appliance 14 is in a power on mode or in a power off mode, the sensitivity of the current monitor can be adjusted using sensitivity adjustment 146 represented in the top view of Figure 4C. As explained in connection with the single universal transmitter 106 (Figures 2A-C), the appliance 14 (Figure 1) is turned on and off while the sensitivity adjustment is varied and a power status LED 152 represented in the front view of Figure 4A indicates the sensed state of the appliance 10. The power status LED 152 tracks the power status of the appliance 14 and the sensitivity adjustment 146 is varied until the power status LED 152 and the actual power state of the appliance 14 agree with each other. Once adjusted, the combined universal transmitter/receiver 130 will advantageously know the power state of the appliance 14 so that in those appliances without discrete power on and power off commands, a command will never be issued which will cause the appliance to toggle to the power off mode when it was desired to power on the appliance, and vice versa. If the combined universal transmitter/receiver 130 senses that the appliance 14 is already on when the combined universal transmitter/receiver 130 receives a "turn on command" for that appliance the issuance of the infrared signal representing the "power on" command to the appliance 14 is inhibited.

Referring now to Figure 4B, also included in the combined universal transmitter/receiver 130 are address selection switches 138 which allow a user to set the address at which the combined universal transmitter/receiver 130 will recognize appliance automation commands present on the signal-carrying bus

104. The combined universal transmitter/receiver 130 includes four address selection switches 138 which, as preferred in the CEBus® automation system, are designated as "house," "device," "number," and "room" but more or fewer address selection switches can also be used in accordance with the present invention and in compliance with other appliance automation system.

As indicated, the combined universal transmitter/receiver 130 receives instructions via the signal-carrying bus 104 which in the present example is the AC wiring bus upon which instructions are conveyed preferably in accordance with the CEBus® appliance automation standard. The combined universal transmitter/receiver 130 includes a processor and interface which allows communication with the signal-carrying bus 104, preferably in accordance with the CEBus® appliance automation standard.

The combined universal transmitter/receiver 130 is installed near the appliance, for example appliance 14 in Figure 1, which is to be controlled. The power cord (partially shown in Figure 4B at 156) of the combined universal transmitter/receiver 130 is preferably received into a conventional NEMA compatible receptacle (not shown in the figures) which is found in both residential and commercial structures connected to the AC wiring bus. The combined universal transmitter/receiver 130 includes a power supply which derives the necessary DC voltage needed to power its internal components.

Referring again to Figure 1, the combined universal transmitter/receiver 130 receives instructions via the signal-carrying bus 104 and is recognized as part of any existing appliance automation system. It is presently preferred that the single universal transmitter 106 include a processor 135, which preferably includes a CEBus® appliance automation system controller such as



that available from Intellon Corporation and referred to as a CENode board in the art.

Figure 4A illustrates a power switch 148 and an LED 154 which shows when the combined universal transmitter/receiver 130 is operating. Also represented in the front view of Figure 4A is an infrared signal reception LED 150 which illuminates when an infrared receiver 134 recognizes an infrared signal.

As represented in Figure 1, the combined universal transmitter/receiver 130 includes an infrared emitter 140 which transmits a modulated infrared signal to the infrared receiver 16 on the appliance 14 to cause the appliance 14 to carry out the desired operations. The infrared emitter 140 is wired to the combined universal transmitter/receiver 130 via a cable 148. As explained in connection with the infrared emitter 116, the infrared emitter 140 is preferably secured over the infrared receiver 16 on the appliance 14 to block the reception of other infrared signals and also provides the same advantages as previously explained.

As was the case with the single universal transmitter 106, the combined universal transmitter/receiver 130 includes a library of infrared codes for several hundred appliances. The code library can preferably be updated or changed in any of the ways known in the art, for example by replacing a read-only memory, via a serial port connection (not represented in the figures), or via the appliance automation network. As shown in the top view of Figure 4C, combined universal transmitter/receiver 130 includes a keypad 144 whereby a user can enter a number on the keypad 128 to select which set of infrared codes from the library of infrared codes will apply as explained earlier. Once the proper number is entered on the keypad 128, the combined universal transmitter/receiver 130 will look up the proper infrared code which properly translates from the instructions received from the appliance automation

network and convey the proper infrared code to the infrared emitter 140 (Figure 1).

From the forgoing description, it will be understood that the installation and operation of the combined universal transmitter/receiver 130 can be readily accomplished. The installation of the combined universal transmitter/receiver 130 consists of a few major steps including: plugging the combined universal transmitter/receiver 130 into the receptacle (not represented) connecting to the AC wiring bus, plugging the controlled appliance into the receptacle 132 on the combined universal transmitter/receiver 130, setting the current monitor threshold by varying the sensitivity adjustment while cycling the appliance on and off and assuring that the power status LED 152 follows the status of the appliance, and inputting the proper number on the keypad 144 which corresponds to the set of infrared codes to which the appliance will respond. A final major step involves the infrared emitter 140 being secured over the appliance's infrared receiver (16 in Figure 1). The combined universal transmitter/receiver 130 is responsive to instructions received from the hand-held transmitter 230 (Figure 5) and those conveyed via the signal-carrying bus (104 in Figure 1). It is also within the scope of the present invention to include the components necessary to control a plurality of appliances from a single device such as the combined universal transmitter/receiver provided with a plurality of outlets and infrared emitters.

It will also be appreciated that the embodiments of the present invention which have been described herein can be adapted to control any appliances which are compatible with the appliance automation system in use. For example, the appliance 18 which is depicted in enclosure 102F includes a CENode controller board 20 and the hand-held transmitter 230 can be configured to control the appliance 18.

Reference will next be made to Figure 6 which is a flow chart representing one preferred method carried out by the single universal transmitter 106 and combined universal transmitter/receiver 130 described herein. Rather than using the CEBus® CAL language, the method of Figure 6 utilizes addressing protocol such as that explained in connection with Table B. It is to be understood that the described method is merely exemplary of the methods of the present invention.

The flow chart of Figure 6 begins at step 250 whereat a signal is received from the appliance automation network, for example the signal-carrying bus 104 represented in Figure 1. The signal is then translated to an address and an infrared code at step 252. At step 254 the address is examined to determine if it contains the proper "house code." If the address does not contain the proper house code, the method ends until another signal is received at step 250. If the address contains a proper house code, then it is determined if the infrared code is within the proper range at step 256. If the signal does not contain a command within the proper code range, the method ends until another signal is received at step 250.

If the infrared code is within the proper range, then it is determined if the signal is a power signal at step 258. If the signal is a power signal then it is determined if the signal is a power on signal at step 260 and if so the method proceeds to step 262 where it is determined if the appliance is already on and if not the method proceeds to step 268. If the appliance is already on, the method ends until another signal is received at step 250. If it is determined at step 260 that the power signal is not a power on signal, it is confirmed that the signal is a power off signal at step 264. If the power signal is a power off signal, it is determined if the appliance is already off and if not the method proceeds to step 268. If the appliance is

already off, the method ends until another signal is received at step 250. At step 258, if it is determined that the signal is not a power signal then the method goes directly to step 268. At step 268 the signal is translated to the proper infrared code for the appliance and the infrared code is then sent to the appliance via the infrared emitter (116 and 232 in Figure 1).

In view of the foregoing, it will be appreciated that the present invention provides a system and method for retrofitting existing appliances for use with appliance automation systems and also provides a system and method for interfacing with appliance automation systems allowing both compatible appliances and non-compatible appliances to be used therewith. The present invention also provides a wireless control system for an appliance automation system and allows existing appliances without any automation capability to be addressed and controlled by an appliance automation system. Moreover, the present invention provides a system and method which replaces many appliance control devices with a single wireless appliance control device and allows control over any appliance in a structure from any location in the structure.

The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description.

What is claimed is:

1. A system for communicating instructions to an appliance from a remote location, the system comprising:

remote means for dispatching a first control signal from the remote location;

means for receiving the first control signal;

means for translating the first control signal into a second control signal, the second control signal including at least a power on command;

means for emitting the second control signal, the second control signal being recognized by the appliance; and

means for sensing whether the appliance is in a power active state or a power-inactive state and for ensuring that the power on command is issued by the means for emitting the second control signal only if the appliance is in a power-inactive state.

2. A system as defined in claim 1 wherein the remote means for emitting a control means comprises one device selected from the group consisting of: a hand-held transmitter, an audio/visual controller, an infrared receiver, and an appliance automation controller.

3. A system as defined in claim 2 wherein the hand-held transmitter comprises:

an infrared emitter;

a plurality of function keys, the plurality of functions keys being programmable to change their function from a previous function to a current function; and

a display, the display including indicia indicating the current function of at least some of the plurality of the function keys.

4. A system as defined in claim 1 wherein the means for receiving the first control signal comprises means for receiving a signal compliant with the CEBus® CAL language.

5. A system as defined in claim 1 wherein the means for translating the first control signal comprises a processor and means for looking up a set of second control signals corresponding to a set of infrared signals which are acceptable to the appliance.

6. A system as defined in claim 1 wherein the means for emitting a second control signal comprises:  
an infrared emitter;

means for attaching the infrared emitter in close proximity to an infrared receiver on the appliance; and

means for connecting the infrared emitter to the means for translating.

7. A system as defined in claim 1 wherein the means for sensing whether the appliance is in a power active state or a power-inactive state comprises;

means for providing AC current to the appliance;

means for sensing the current drawn by the appliance;

means for comparing the current drawn by the appliance with a predetermined threshold;

means for manually varying the predetermined threshold;

means for perceptibly indicating to a user when the current drawn by the appliance exceeds the predetermined threshold; and

means for preventing the means for emitting a second control signal from emitting a power on command if the current drawn by the appliance exceeds the predetermined threshold.

8. A system as defined in claim 1 further comprising means for selecting an address for the means for receiving the first control signal.

9. A system as defined in claim 1 further comprising:

means for receiving an infrared signal containing instructions for the appliance; and

means for modulating an information carrying bus with the first control signal containing the instructions for the appliance and for including an address for the appliance with the first control signal.

10. A system for communicating control signals from a first remote location to a first appliance contained within a structure including a power distribution bus, the system comprising:

remote means for emitting a first control signal from the first remote location;

means for receiving the first control signal;

means for translating the first control signal into a second control signal, the second control signal including at least a power on command;

means for transmitting the second control signal over the power distribution bus;

means for receiving the second control signal from the power distribution bus and translating the second control signal into a third control signal, the means for receiving the second control signal being in physical proximity with the first appliance;

means for emitting an infrared signal corresponding to the third control signal; and

means for sensing whether the first appliance is in a power active state or a power-inactive state and for ensuring that the power on command is issued by the means for emitting an infrared signal only if the first appliance is in a power-inactive state.

11. A system as defined in claim 10 wherein the remote means for emitting a first control signal comprises a hand-held transmitter.

12. A system as defined in claim 11 wherein the hand-held transmitter comprises:

an infrared emitter;

5 a plurality of function keys, the plurality of functions keys being programmable to change their function from a previous function to a current function; and

10 a display, the display including indicia indicating the current function of at least some of the plurality of the function keys.

13. A system as defined in claim 10 wherein the means for transmitting the second control signal comprises:

15 means for modulating an information carrying bus with the first control signal containing the instructions for the appliance and for including an address for the appliance with the first control signal.

20 14. A system as defined in claim 10 wherein the means for receiving the second control signal from the power distribution bus and translating the second control signal into a third control signal comprises a processor means and means for looking up a set of second control signals corresponding to a set of infrared signals which are acceptable to the appliance.

25 15. A system as defined in claim 10 wherein the means for sensing comprises;

means for providing AC current to the first appliance;

30 means for sensing the current drawn by the first appliance;

means for comparing the current drawn by the first appliance with a predetermined threshold;

35 means for manually varying the predetermined threshold;



means for perceptibly indicating to a user when the current drawn by the first appliance exceeds the predetermined threshold; and

5 means for preventing the means for emitting a second control signal from emitting a power on command if the current drawn by the appliance exceeds the predetermined threshold.

10 16. A system as defined in claim 10 wherein the means for receiving the first control signal further comprises means for conveying a third control signal on a signal-carrying bus to a second appliance.

15 17. A system for communicating control signals from either of a first remote location or a second remote location to a first appliance at a first location or to a second appliance at a second location, the first and the second locations both contained within a structure including a power wiring bus, the system comprising:

20 remote means for emitting a first control signal, the remote means being movable between the first remote location to the second remote location and including a battery;

means for receiving the first control signal at the first remote location;

25 means for translating the first control signal into a second control signal, the second control signal including at least a power on command and at least one address;

30 means for transmitting the second control signal over the power distribution bus;

35 first means for receiving the second control signal from the power distribution bus and translating the second control signal into a third control signal, the first means for receiving the second control signal being in physical proximity with the first appliance;

first means for decoding the address and determining if the address matches the first appliance address;

5 first means for conveying the third control signal to the first appliance;

second means for receiving the second control signal from the power distribution bus and translating the second control signal into a third control signal, the second means for receiving the  
10 second control signal being in physical proximity with the second appliance;

second means for decoding the address and determining if the address matches the second appliance address;

15 second means for conveying the third control signal to the second appliance; and

means for sensing whether the first appliance is in a power active state or a power-inactive state and for ensuring that a power on command is issued by the first means for conveying the third control signal only if the appliance is in a power-inactive state.

20 18. A system for retrofitting an appliance having an infrared receiver for intercepting coded infrared commands, the system comprising:

25 means for receiving a first control signal generated by an appliance controller;

means for translating the first control signal into a second control signal, the second control signal including at least a power on command;

30 means for emitting an infrared signal corresponding to the second control signal, the infrared signal being recognized by the appliance, and for directing the infrared signal into the infrared receiver;

35 means for providing operational voltage and current to the appliance; and

means for sensing the current flow through the  
means for providing operational voltage and current  
to determine whether the appliance is in a power  
active state or a power-inactive state such that  
the power on command is issued by the means for  
emitting the second control signal only if the  
appliance is in a power-inactive state.

19. A system as defined in claim 18 wherein the  
means for receiving the first control signal comprises  
means for receiving a signal compliant with the CEBus®  
CAL language.

20. A system as defined in claim 18 wherein the  
means for translating the first control signal into a  
second control signal comprises a processor and means  
for looking up a set of second control signals  
corresponding to a set of infrared signals which are  
acceptable to the appliance.

21. A system as defined in claim 18 wherein the  
means for emitting an infrared signal corresponding to  
the second control signal comprises:

an infrared emitter;

means for attaching the infrared emitter in  
close proximity to the infrared receiver on the  
appliance; and

means for connecting the infrared emitter to  
the means for translating.

22. A system as defined in claim 18 wherein the  
means for providing operational voltage and current to  
the appliance comprises a NEMA compatible receptacle  
providing AC power.

23. A system as defined in claim 18 wherein the  
means for sensing the current flow comprises:

means for sensing the current drawn by the  
appliance;

means for comparing the current drawn by the  
appliance with a predetermined threshold;

means for manually varying the predetermined threshold;

means for perceptibly indicating to a user when the current drawn by the appliance exceeds the predetermined threshold; and

means for preventing the means for emitting an infrared signal from emitting a power on command if the current drawn by the appliance exceeds the predetermined threshold.

24. A system for controlling an appliance from a remote location, the system comprising:

means for emitting a wireless first control signal from the remote location representing a first appliance function, the first control signal consisting of a code which is not recognized by the appliance;

means for receiving the wireless first control signal;

means for translating the first control signal into a second control signal, the second control comprising a code which is recognized by the appliance as representing the first appliance function; and

means for conveying the second control signal to the appliance such that the appliance carries out the function represented by the second control signal.

25. A system for controlling an appliance from a remote location as defined in claim 24 wherein the means for emitting a wireless first control signal comprises means for selecting a set of codes which correspond to the functions of the first application and means for selecting a set of codes which correspond to the functions of a second appliance.

26. A system for controlling an appliance from a remote location as defined in claim 24 wherein the means for translating the first control signal into a second

control signal comprises a processor positioned at least adjacent to the appliance.

27. A system for controlling an appliance from a remote location as defined in claim 26 wherein the means for translating further comprises an infrared emitter.

28. A system for controlling an appliance from a remote location as defined in claim 24 wherein the means for conveying the second control signal comprises an infrared emitter.

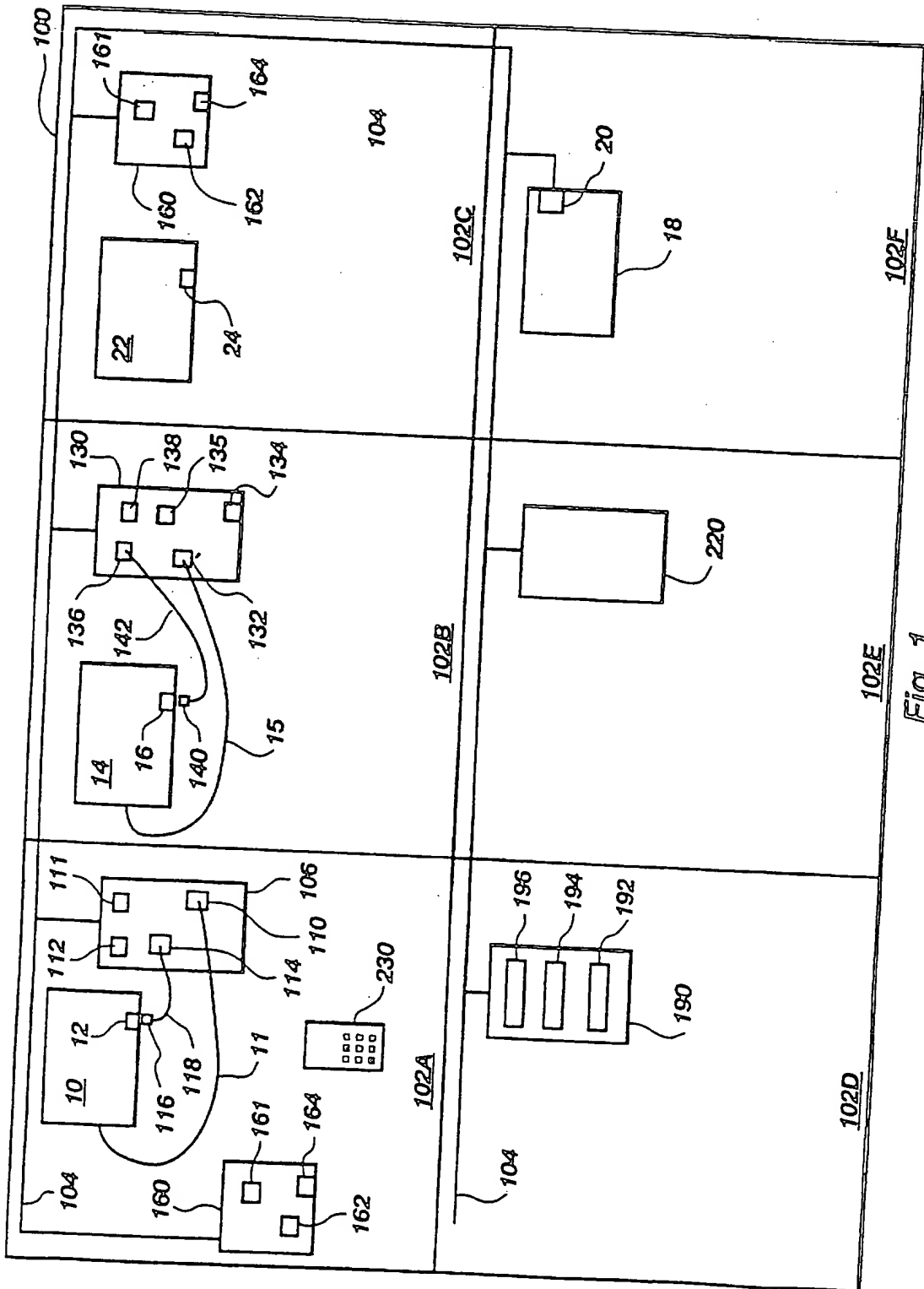
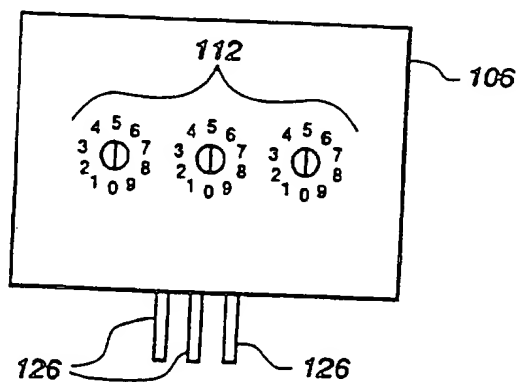
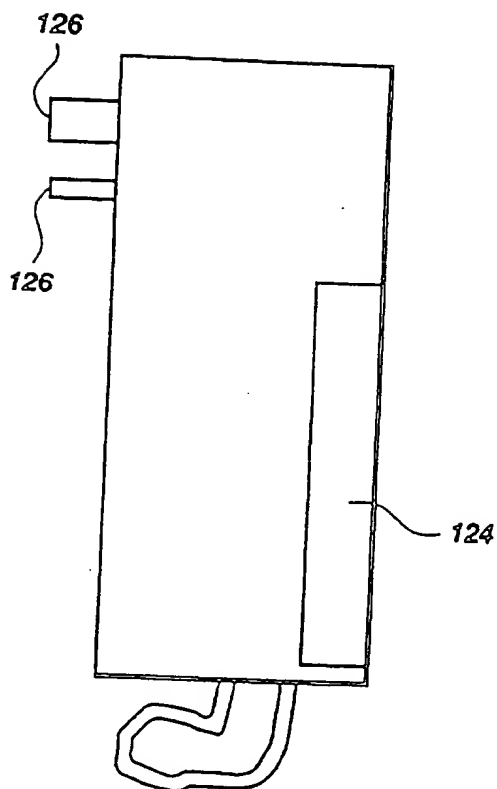
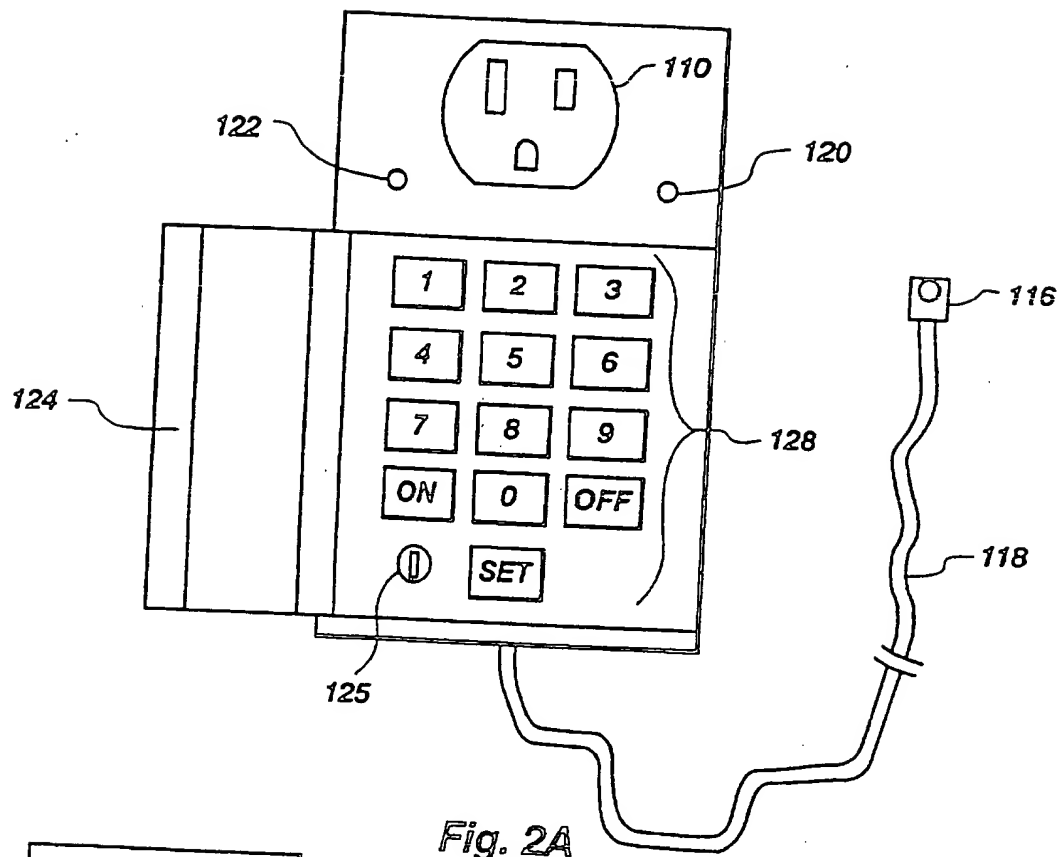


Fig. 1

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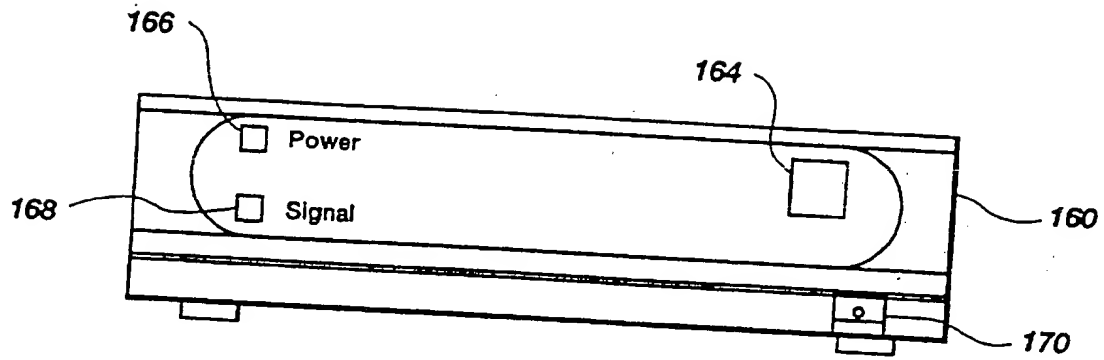


Fig. 3A

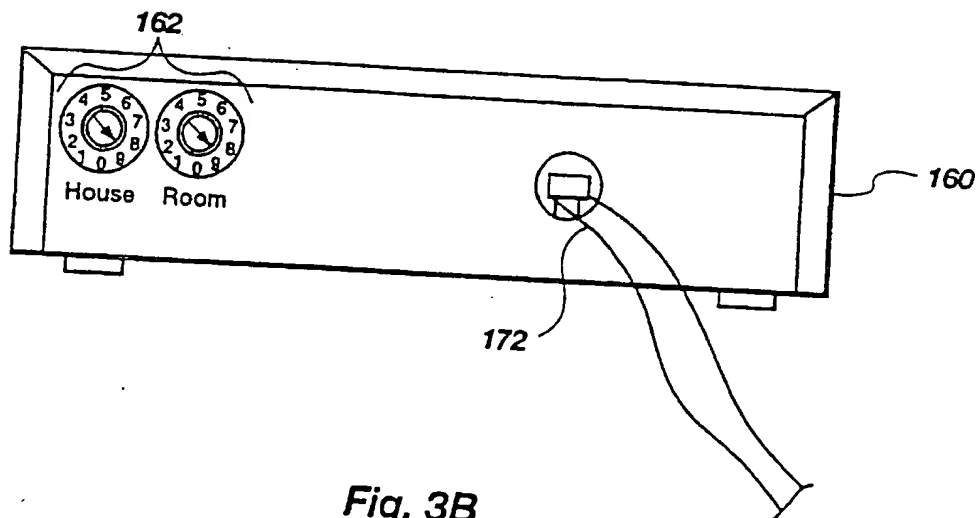


Fig. 3B

SUBSTITUTE SHEET (RULE 26)



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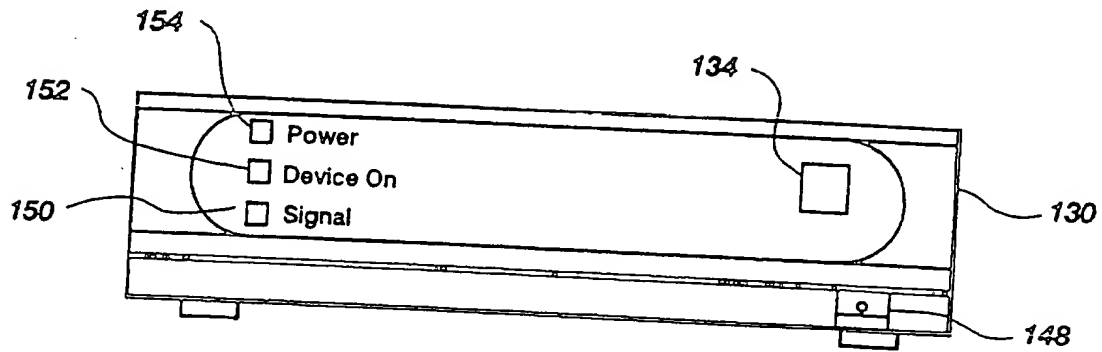


Fig. 4A

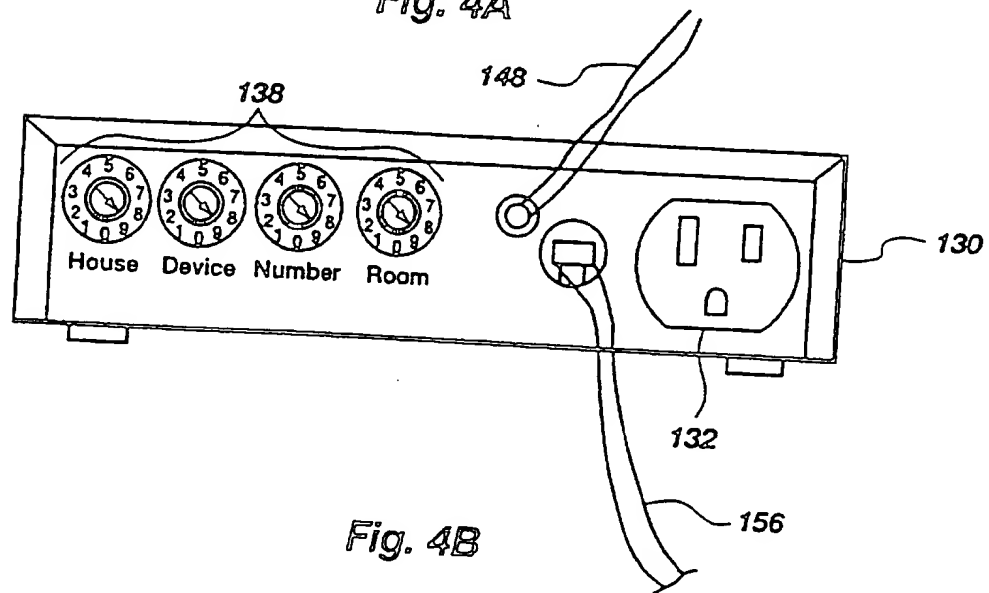


Fig. 4B

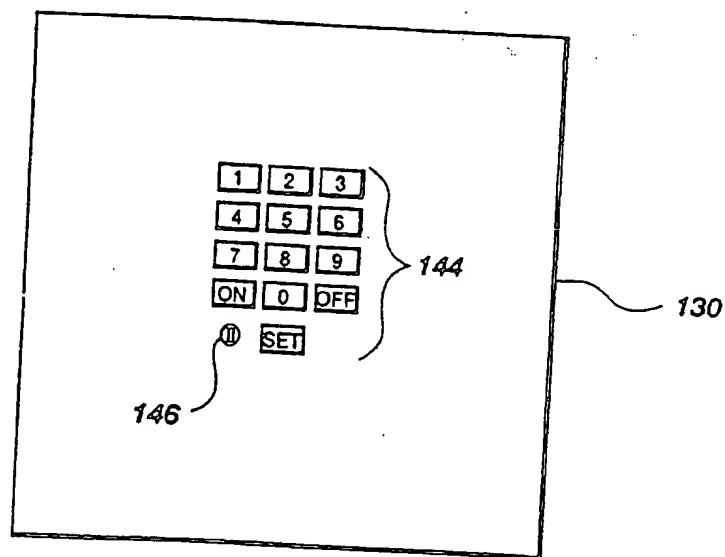


Fig. 4C  
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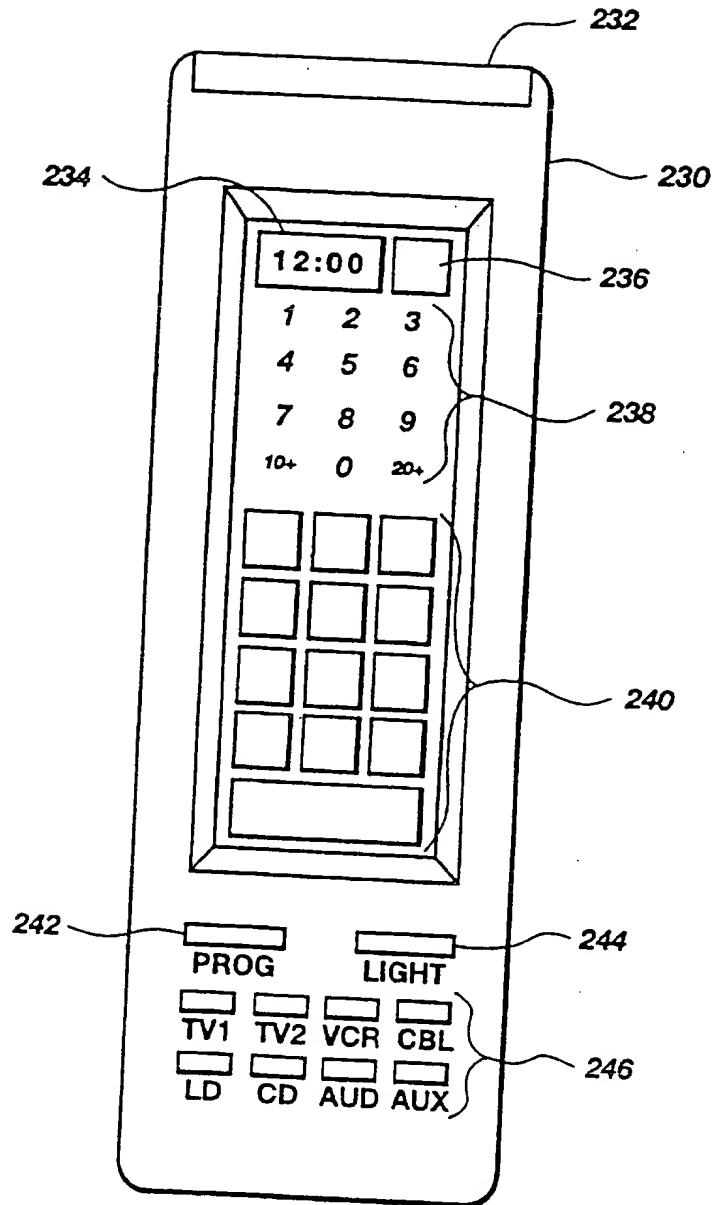
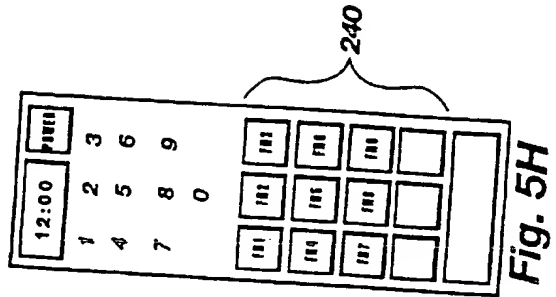
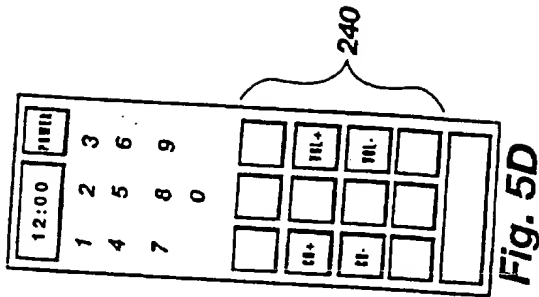
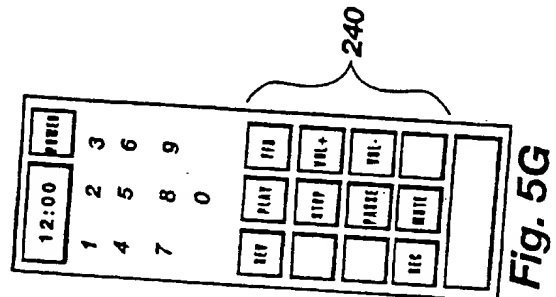
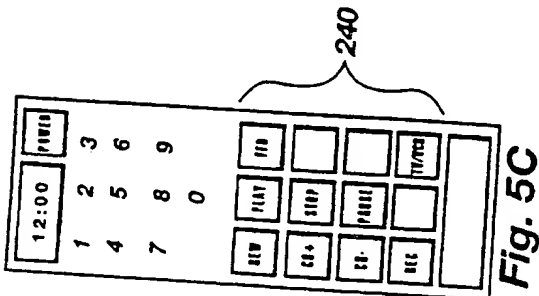
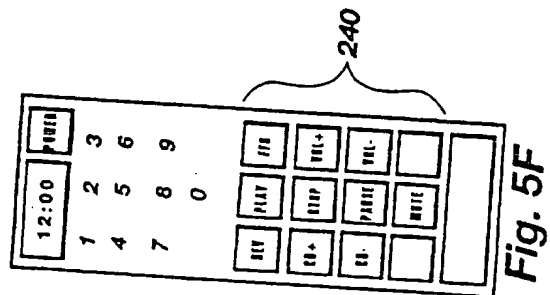
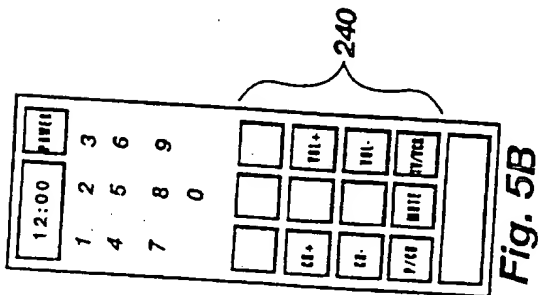
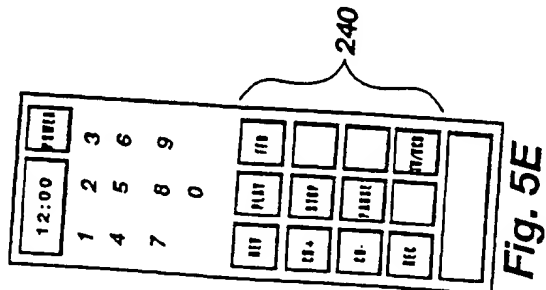
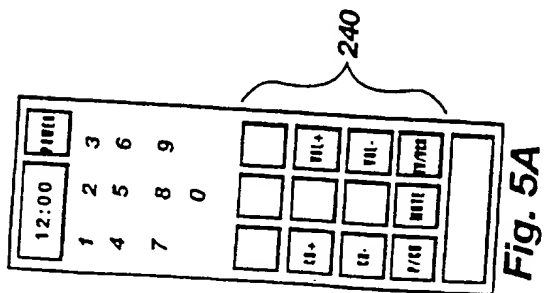


Fig. 5



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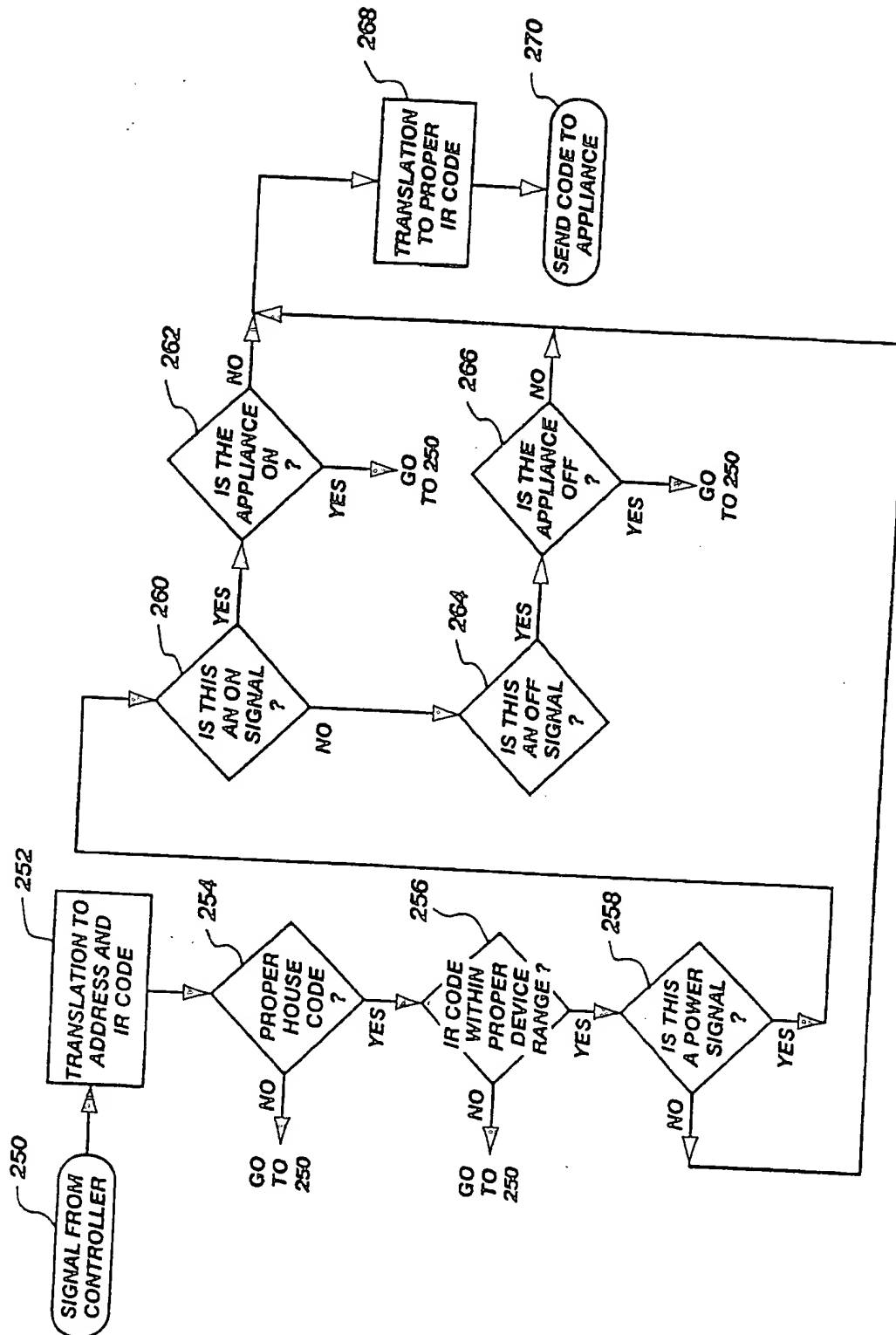


Fig. 6

## INTERNATIONAL SEARCH REPORT

Internat. application No.  
PCT/US95/13598

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : H04Q 9/08

US CL : 340/825.52

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 307/11, 38, 40, 42; 340/825.52, 825.56, 825.72, 310.01, 310.02

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS

search terms: remote control, appliance

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5,051,720 (KITIRUTSUNETORN) 24 September 1991, entire document.	1-28
Y	US, A, 5,352,957 (WERNER) 04 October 1994, col 2, lines 54-68.	1-28
Y	US, A, 4,746,919 (REITMEIER) 24 May 1988, col. 3, lines 20-27, lines 24-28, and lines 50-55.	2, 10-28
Y	US, A, 4,418,333 (SCHWARZBACH ET AL.) 29 November 1983, col. 2, lines 44-66; col. 12, lines 13-17.	7, 10-28
Y	US, A, 5,086,298 (KATSU ET AL.) 04 February 1992, col. 2, line 68.	8-28

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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* P* document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

12 MARCH 1996

Date of mailing of the international search report

25 MAR 1996

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